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RELATIONSHIP BETWEEN AGE AND SERUM LIPIDS IN MALNOURISHED AND WELL-FED PRE-SCHOOL CHILDREN IN ZARIA, NIGERIA

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ABSTRACT

Objective: The objective of this study was to evaluate the relationship between age and serum total cholesterol (TC) and triglyceride (TG) in malnourished and well-fed pre-school Nigerian children in Zaria, northern Nigeria.

Materials and Methods: Serum total cholesterol (TC) and TG concentrations were measured in 115 malnourished and 115 age- and gender-matched well-fed children aged one (1)-three (3) years. These consisted of 25, 30, 30 and 30 children with kwashiorkor, marasmic-kwashiorkor, marasmus and underweight, respectively with their corresponding age- and gender-matched well-fed children. There were 60 males and 55 females each of malnourished and well-fed children. Concentrations of TC and TG were measured by enzymatic colorimetric method using reagent kits supplied by HUMAN, Gesel Für Biochemical Und Diagnostica mbH (Wiesbaden, Germany).

Results: There was no correlation between age and serum TC in malnourished children ($r = 0.0101$, $p = 0.9250$), while the correlation was negative and significant in well-fed children ($r = 0.3599$, $p = 0.3110$). Similarly, there was no correlation between age and serum TG in malnourished children ($r = 0.0605$, $p = 0.4623$) but negative and significant correlation in well-fed children ($r = 0.3210$, $p = 0.0001$).

Conclusion: The findings of this study demonstrate that in well-fed pre-school children, serum lipids decrease with advancing age and that this pattern was abolished in malnourished children. This contribution should be noted and considered when interpreting serum lipid results in children.

Key Words: Protein-energy malnutrition, malnourished children, well -fed children, serum lipids, pre-school children.
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INTRODUCTION

Measurement of serum lipids forms one of the special tests in most clinical chemistry laboratories worldwide. This is important in the management of patients with cardiovascular diseases¹ and monitoring patients with diabetes mellitus² as well as in the assessment malnutrition in children³⁻⁵. Serum lipids are under multi-factorial control mechanisms. Both genetic, environmental factors, types of food and age influence the levels of these parameters in children and adults⁶⁻¹⁰. Protein-energy malnutrition (PEM) is the most common nutritional disorder affecting children in developing countries¹¹ and the third most common disease of childhood¹². Malnutrition has a great impact on the health care delivery system, resulting in reduced quality of life for the affected patients and added financial costs to the hospital where the patients are receiving care. Several reports across the world suggest that serum lipids were deranged in malnourished children^{2,13-16}.

Such serum lipids include total cholesterol (TC) and triglycerides (TG). There is paucity of data on relationship between age and serum lipids in malnourished children. Knowledge of this relationship in both malnourished and well-nourished children of the same age gender could be of clinical importance in the assessment of malnutrition in children. The aim of the present study was to evaluate the relationship between age and serum cholesterol (CHOL) and TG in malnourished and age- and gender-matched well-fed children.

MATERIALS AND METHODS

The study was conducted in Ahmadu Bello University Teaching Hospital (ABUTH), Zaria Northern Nigeria. This study was approved by the Ethical Committee of the ABUTH, Zaria in accordance with the declaration of Helsinki. A total of 115 malnourished children aged 6 to 36 months were studied. These consisted of 60 male and 55 female children. The malnourished children were classified using Wellcome Trust Classification¹⁷. There were 25, 30, 30 and 30 children with kwashiorkor, marasmic- kwashiorkor, marasmus

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and underweight, respectively. All the malnourished children were recruited from patients attending the Paediatric Out Patient Department (POPD) clinic as well as patients admitted to Paediatric Medical Ward (PMW) and Emergency Paediatric Unit (EPU) of ABUTH. At the respective locations, arrangements were made with the paediatricians whereby consecutive children who satisfied the study inclusion criteria were selected. These include children who were presented with features suggestive of PEM such as weight loss, oedema, apathy, skin and hair changes. Informed consent for inclusion into the study was obtained from the parents/guardians of such patients. All children whose parents/guardians declined to give consent for inclusion were excluded from the study. The nature of the study was explained to the parents/guardians in the appropriate language. A full medical history was obtained from the parents/guardians of any selected child. This was followed by a detailed physical examination, anthropometric measurements and collection of blood specimens. For each malnourished child recruited, an age- and gender- matched control (well-fed) child was selected from cases presenting to POPD clinic with mild ailments such as colds and fever. These cases had none of the features of PEM. The same clinical evaluation was carried out on the controls. Each child was weighed, wearing only underpants on scale sensitive to nearest 50 g. The height of each child, fully stretched was measured to the nearest centimeter, using a sliding board. Similarly, mid-upper arm circumference (MUAC) was measured to the nearest centimeter, using inelastic measuring tape. Blood specimens were taken into plain tubes, using sterile technique. The blood was centrifuged and the serum was carefully drawn into sample bottles and then stored frozen at -20°C until the time for analysis. The samples were analyzed for total TC and TG by enzymatic colourimetric method¹⁸ using reagent kits supplied by HUMAN, Gesel Für Biochemica Und Diagnostica mbH (Wiesbaden, Germany). The data obtained were analysed using SPSS 9.0 for Windows (SPSS Inc., Chicago, IL). Correlations of age with serum TC and TG were carried out using Pearson's linear correlation analysis. A p-value of equal to or less than 0.05 ($p = 0.05$) was considered as statistically significant.

RESULTS

The anthropometric measurements (Mean \pm SEM) for the total group of well-fed and malnourished children are shown in Table 1. Fig. 1 illustrates the relationship between age and serum TC in well-fed children. There was no correlation between age and serum TC in malnourished children ($r = 0.0101$, $p = 0.9250$), while the correlation was negative and

significant in well-fed children ($r = 0.3599$, $p = 0.3110$). Similarly, there was no correlation between age and serum TG in malnourished children ($r = -0.0605$, $p = 0.4623$) but negative and significant correlation in well-fed children ($r = 0.3210$, $p = 0.0001$) as shown in Fig. 2. Serum TC and TG concentrations decrease with advancing age in well-fed pre-school children but constant in malnourished children.

Table 1: Anthropometric Measurements (Mean \pm SEM) in PEM Patients and age - and Gender-Matched Controls.

Subjects	n	Weight, kg (\pm SEM)	Height, cm (\pm SEM)	*MUAC, cm (\pm SEM)
Patients	115	6.33 (0.11)	71.75 (0.49)	11.20 (0.11)
Controls	115	10.41 (0.15)	74.69 (0.46)	15.22 (0.12)
p-value		<0.001	<0.001	<0.001

*Where MUAC= Mid Upper-arm Circumference

Figure 1: Relationship between Age and Serum Total Cholesterol in Apparently Healthy Children.

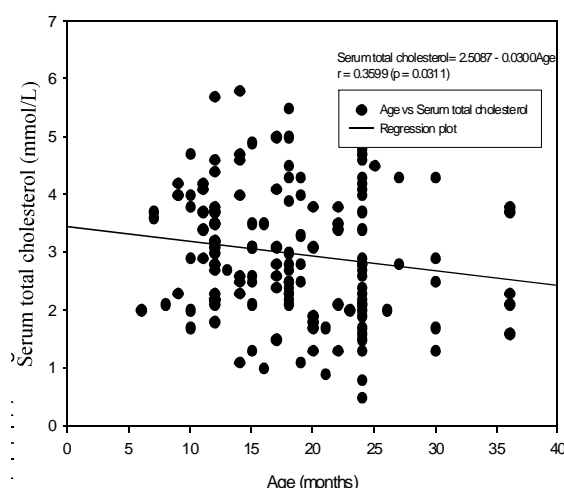
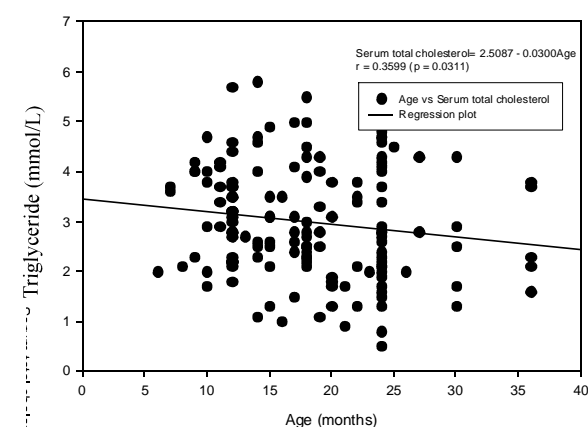


Figure 2: Relationship between Age and Serum Triglycerides in Apparently Healthy Children.



DISCUSSION

The findings of this study demonstrate that in well-fed pre-school children, serum TC and TG decrease with advancing age and that this type of relationship was abolished in malnutrition. The rate of decrease in serum TC and TG concentrations was higher between first and second years than between second and third years of childhood. These findings are consistent with the series by John¹⁹. The type of relationship observed between age and serum TC and TG in well-fed children could be related to the type of diet and feeding habit of these children. It is known that effective and probably exclusive breastfeeding take place within the first and possibly the second years of childhood. It is also known that breast-milk is the most richest source of all nutrients, including cholesterol (CHOL) and TG required for the development of the children and that infant formula differs from human-milk in their chemical compositions, human lower concentrations of CHOL and TG than in breast-milk²⁰. This is also in agreement with the findings of Boadiman et al²¹ and Kallio et al²² who reported higher serum CHOL in babies on breast-milk than in those on cow-milk and other human-milk substitute formula. Therefore, these findings suggest that as the children are weaned and their routine diets changed to formula and mixed food, which may be low in total lipid, serum CHOL and TG concentrations begin to decrease. This is consistent with the finding of decrease in serum TC and TG with advancing age in the present study. The observations of this study also demonstrate that the normal pattern of serum lipids does not exist in the presence of malnutrition during early childhood. This could be due to the fact that most of the malnourished children were affected by the same adverse clinical consequences like reduced food intake often due to decreased appetite, infection, starvation, malabsorption and increased metabolic losses of nutrients or an initial nutrients deficiency. The findings of the present study agree with reports by other workers who observed varying degrees of the derangement of serum lipids such as reduced levels of CHOL and TG^{3,13-16}. This reduction in serum lipids could be related to the decreased intake of nutrients or to the decreased ability of the liver cells to metabolize lipid in form of lipoproteins²³. Lipoprotein lipase (LPL), the rate-limiting enzyme in the hydrolysis of plasma TG²⁴ activities were found to be significantly reduced in malnourished children, more pronounced reduction in kwashiorkor than in marasmus^{18-16,25}. LPL, present in adipose tissue, heart, liver and several other tissues plays a key role in the removal and utilization of circulating chylomicrons (CM) and very low density lipoprotein (VLDL)¹⁴. The reduction of LPL activities is associated with the low serum TG, which probably

Resulted from reduced synthesis of VLDL-lipoprotein, concomitant with the liver lipid accumulation and low levels in serum¹³⁻¹⁶.

It can be concluded from the findings of the present study that concentrations of serum TC and TG were deranged in malnourished children during pre-school period and this may have long-standing effects on brain metabolism. This study therefore suggests that measurement of serum CHOL and TG could be of importance in the assessment of malnutrition in affected children. This contribution should be noted and considered when interpreting serum lipid results in children.

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